PCCP Overlays - Indiana Lessons & Experience

CPAM Concrete Paving Workshop
March 16, 2018
PCCP Overlay Preservation Option

- Original Pavement
- Increase due to Rehabilitation

Structural/Functional Condition:

Min. Acceptable Rating

Terminal Condition:

Age or Traffic

ACPA
INDIANA CHAPTER
Rehabilitation Strategies

Concrete Pavements

• Maintenance/Restoration
  ➢ Full-depth repair
  ➢ Partial-depth repair
  ➢ Diamond grinding
  ➢ Joint & crack resealing
  ➢ Retrofitting dowels
  ➢ Cross-stitching long. cracks/joints

• Resurfacing
  ➢ PCCP Overlays

• Reconstruction
Performance Data

Pathways Van Data Collection of existing PCCP overlays
Performance Data

Pathways Van Data Collection of existing PCCP overlays
What are we talking about??

- Concrete overlays over old concrete
- Concrete overlays over old asphalt pavements
- Concrete overlays over old composite pavements
Widely Used Across the Country
Concrete Overlays

Guidance on Design and Construction
Bonded Resurfacing of Asphalt or Composite Pavements

- Use when existing pavement is in fair or better structural condition with surface distress.
- Use to eliminate any surface defects; increase structural capacity; and improve surface friction, noise, and rideability.

4”–6” thickness
Mechanics of PCCP Overlays

Unbonded

Bonded

Neutral Axis
Short Joints
Reduce Stresses
Evaluations of Existing Pavements for Overlays

• An evaluation of the existing pavement is necessary to ensure it is a good candidate for resurfacing and structurally sound to carry the anticipated traffic loads.

• Information gathered through the evaluation is used to determine required repairs where needed and to establish the concrete overlay design thickness.

• Strongly suggest – **take cores of existing pavement**

• Concrete material condition can be obtained through analysis of cores taken from the existing pavement.
Pavement Evaluation:

On high-volume roads, falling weight defectometer (FWD) testing can provide subgrade k-values and variability, concrete modulus, load transfer efficiency, and presence of voids.
Thin PCCP Overlays
A Preservation Option

• Another tool in the tool box – “Mix of Fixes”
• Thin PCCP Overlays provide a longer term preservation option at a competitive cost
• New technology – “game changer”

High Strength
Macro Synthetic Fibers
Residual Strength

Residual strength = the load that damaged object can carry without failing

\[ R_{T,150}^D = \frac{150 \cdot TD_{150}}{d^2} \cdot f_1 \cdot b \]

Fiber dosage required for 20%
SECTION 509 – QC/QA, PCC OVERLAYS

509.01 Description
This work shall consist of a QC/QA, PCCP overlay placed on a prepared existing asphalt pavement in accordance with 313.03. The requirements of 501 shall apply except as modified herein.

509.02 Lots and Sublots
Lots will be defined as 0.4909 yd² (1,200 ft²) of PCCP. Lots will be further subdivided into sublots of 0.4909 yd² (1,200 ft²) of PCCP within a lot. Partial sublots of 0.4909 yd² (1,200 ft²) or less will be added to the previous sublots. Partial sublots greater than 0.4909 yd² (1,200 ft²) will constitute a full sublot. Partial lots of one or two sublots will constitute a full lot.

Lots and sublots will be numbered and tested for a given pay item regardless of the number of CMT’s used and will be closed out at the end of the paving season or construction phase.

509.03 Preparation of Existing Asphalt Pavement
The requirements of 501.10, 501.11 and 501.12 shall not apply.

Preparation of the existing asphalt pavement shall be in accordance with the requirements of 501 except as modified herein.

Asphalt modification and pavement repair shall be performed on the existing asphalt pavement in accordance with 356.05. Stabilization of PCCP for milling shall be in accordance with JEM 803 section 5.3. The prepared existing asphalt surface shall be clean to crumbly coarse using a tooth broom in accordance with JEM 803.

The Contractor may leave milled surfaces open for an unlimited period of time. Liquidated damages will not be assessed in accordance with 501.12 if the milled surface is left open to traffic for longer than 5 weeks, 2 weeks in the winter, and 10 work days.

Prior to placement of PCCP, the existing asphalt pavement shall be clean and free of loose material. The surface of the milled asphalt pavement shall be uniformly moistened with water just prior to placement of PCCP. Excessive standing water will not be permitted.

Placement of PCCP overlay shall be by the airformed or formed methods with equipment specified in 508.04.

509.04 Sublots
The requirements of 501.18 shall not apply.

Longitudinal and transverse construction joints shall not be saw-cut or sealed. The vertical surface of transverse construction joints shall be formed as shown in the plans.

SR 161, Dubois County

Thin Bonded Overlays
PCC Overlay USP – Changes of Note

• New Lot & Sublot size
  - Lot – 14,400 sys
  - Sublot – 4800 sys

• Coring for thickness lot size
  - 2 cores per 2400 sys

• Opening to traffic strengths
  - 350 psi for local traffic
  - 550 psi for construction traffic
PCC Overlay USP – Changes of Note

• Construction Engineering shall be provided to control milling operations (A bid item)
• The Contractor shall develop a design centerline profile that:
  ▪ optimizes pavement smoothness, maintains minimum overlay depth across the width of the pavement
  ▪ does not exceed the maximum allowable change in profile grade as shown on the plans
  ▪ optimizes the quantity of QC/QA PCC, Additional, as it relates to the material between the milled irregular surface of the asphalt pavement and the bottom of the thin PCC overlay
PCC Overlay USP Mix Changes of Note

- The CMD shall contain at least one, but no more than two SCM’s, and produce workable concrete mixtures having the following properties:

  - Minimum total cementitious .................................................. 500 lbs/cy
  - Allowable amount of single SCM, % of total cementitious, by weight.......................................................... 20.0 - 40.0% \(^A\)
  - Allowable amount of two SCM’s, % of total cementitious, by weight.......................................................... 25.0 – 40.0% \(^B\)
  - Min. portland cement content................................. 350 lbs/cy
  - Allowable amount of silica fume SCM, % of total cementitous content.................................................. 3.0 – 7.0%
  - Max. w/c – mixture with fly ash SCM......................... 0.440
  - Max. w/c - mixture with ggbsf SCM......................... 0.450
  - Target air content defined by CMDP......................... 7.0%
  - Min. flexural strength, 1/3 point loading...... 570 psi at 7 days
Quality Tests - Mixes with Macro Fibers

- Flexural Strength
- Air Content
- Unit Weight
- Water/cementitious ratio

No change – evaluate with standard tests & specimen prep
PCC Overlay USP – Jointing Changes

• In gap areas ≥ 60’, pressure relief joint filler shall be installed at each end of the gap. (<60’ only at one end)

• Joints shall be perpendicular to the finished surface of the PCC thin overlay, shall be 1/8 in. in width

• Shall have a minimum depth of T/3, where T is the design thickness of the PCC thin bonded overlay.

• Joints are not filled/sealed
Other notable changes

- Curing of the thin PCC overlay shall be in accordance with 501.20 except that each of the two applications of white pigmented curing compound shall be at a rate not less than one gallon/100 sq. ft.

- Smoothness
  - Posted > 45 mph – profilograph spec
  - Posted < 45 mph – 16’ straightedge
PCCP Overlays
- INDOT Project Case Studies

Projects & Lessons Learned
INDOT Overlay – Bonded over Asphalt

• SR 161 – SR 64 to Holland - 6”
• Overlay over milled existing HMA pavement
• Joints sawed at 10’ – 10’x12’ panel
• No Dowels – No tie bars
• Road closed to thru traffic
• Local traffic maintained one way
• Access maintained to residents
• 77,000 sys – bid at $14.00/sy
• Built 2010
SR 161 Concrete Overlay
INDOT Overlay – Bonded over Asphalt

- SR 55 – SR 2 to US 231 - 4"
- Utilized Structural Macro fibers
- Overlay over milled existing HMA pavement
- Joints sawed at 7’ – 7’x6’ panels
- No Dowels or tie bars
- Road closed to thru traffic
- Local traffic maintained one way
- Access maintained to residents
- 151,000 sys – bid at $21.00/sy
- Built 2015
SR 55 Concrete Overlay
SR 55
INDOT Overlay – Bonded over Composite

- SR 3 – US 67 S of Muncie to CR 300N N of New Castle – 4 lane divided highway
- 4.5” thick - Utilized Structural Macro fibers
- Overlay over milled existing HMA on PCCP
- Joints sawed at 6’ x 6’ panels
- No Dowels or tie bars
- Traffic maintained one-lane NB & SB
- Access maintained to residents
- 336,186 sys – bid at $20.05/sy
- Being Constructed 2017 & 2018
SR 3 – Macro Structural Fiber Addition
SR 3 – Macro Structural Fiber Addition
INDOT Overlay – Bonded over Asphalt

- SR 161 Ph II – From Holland to SR 62 – 4.5”
- Overlay over milled existing HMA pavement
- Joints sawed at 6’ x 6’ panel
- No Dowels – No tie bars
- Road closed to thru traffic
- Local traffic maintained one way
- Access maintained to residents
- 56,626 sys – bid at $27.00/sy
- Project completed September 2017
INDOT Overlay – Bonded over Asphalt

• SR 9 - Marion – From SR 26 to SR 37 – 4.5”
• Overlay over milled existing HMA pavement
• Joints sawed at 6’ x 6’ panel
• No Dowels – No tie bars
• Road closed to thru traffic – south 4 mi paved full width – 30’ wide
• Local traffic maintained one way
• Access maintained to residents
• 101,178 sys – bid at $25.65/sy
• PCC paving completed 10/25/17
SR 9 - Marion
SR 9 Shelbyville – 6.0” PCC Overlay w/ Structural Fiber

- 20% Residual Strength
- 2 lanes wide
- 9 mi long
- 142,456 sys
- Bid: 7/12/17
- Build 2018

To be constructed 2018
US 50 – 4.5” PCC Overlay w/ Structural Fiber

- 20% Residual Strength
- 4 lanes wide
- 12 mi long
- 362,280 sys
- Bid: 10/12/17
- Build 2018

To be constructed 2018
US 52 – 5” PCC Overlay & 8” Shoulder w/ Structural Fiber

- 20% Residual Strength
- 4 lanes wide
- Approx. 5 mi long
- 142,560 sys
- Bid: 12/13/17
- Build 2018

To be constructed 2018
Surface Preparation
Cleaning the Surface to Prepare for Bonding

• Sweeping surface followed by compressed air cleaning in front of the paver.

• Air blasting or water blasting is only necessary to remove material that cannot be removed any other way.

• Water or moisture should not be on the surface prior to paving or de-bonding can occur.

**Duct Tape Test**
Surface Prep

SR 3

SR 55
Traditional Construction
Traditional Construction
Placement
Placement

SR 161
Pay attention to finishing & its impact on smoothness
Finishing – SR 3
Tined Surface
SR 3
Curing

- Curing is especially critical to concrete resurfacing because their high surface area to volume ratio makes them more susceptible to rapid moisture loss.
- Apply ASAP
- Coat all exposed edges.
- Avoid extreme weather.
- Avoid contact of cure with prepared surfaces because it is a bond breaker
Sawing

SR 161 – PH II
Traffic Control – Lessons learned

- Can manage traffic through the project
- Closed to thru traffic – local access only appears to work best
  - One way thru work zone
  - Contractor needs to aggressively manage
  - Need adequate signage
  - Need cones & warning tape
  - Aggressive flaggers
- Can manage local access to home & businesses
  - Requires regular communication with locals – discuss schedule & options
Local Traffic – one-way thru project
Closed to traffic – Pave Full Width – 30’

SR 9 - Marion
Access to local drives/cross traffic
Access to local drives – SR 55

Make sure surface is clean & provide compression relief at construction joint
Safety Focus – A MUST!!
Tight – restricted workzone
Freshly Cured PCCP – looks a lot like hardened PCCP traffic driving on
Value Analysis

1 mile of pavement – 24’ wide - = 2 lane miles = 14,080 sys

**SR 161 PCCP Overlay** – bid at $14.00/sys
Design life: 25 years - Cost/lane mile/year = $3942.40
Design life: 20 years – Cost/lane mile/year = $5280.00

**HMA Overlay** – expected life 11-13 years
165# HMA Surface = 0.0825T/sys - @$53.25/T = $4.39/sys
275# HMA Intermediate = 0.1375T/sys - @ $53.00/T = 7.29/sys
Cost/lane mile/year (at 11 years) = $7475.20
Cost/lane mil/year (at 13 years) = $6325.17
Value Analysis

1 mile of pavement – 24’ wide - = 2 lane miles = 14,080 sys

SR 55 PCCP Overlay – bid at $21.47/sys

Design life: 25 years - Cost/lane mile/year = $6045.95
Design life: 20 years – Cost/lane mile/year = $7557.44

HMA Overlay – expected life 11-13 years

165# HMA Surface = 0.0825T/sys - @$53.25/T = $4.39/sys
275# HMA Intermediate = 0.1375T/sys - @ $53.00/T = 7.29/sys

Cost/lane mile/year (at 11 years) = $7475.20
Cost/lane mil/year (at 13 years) = $6325.17
Value Analysis

1 mile of pavement – 48’ wide - = 4 lane miles = 28,160 sys

SR 3 PCCP Overlay – bid at $20.05/sys
Design life: 25 years - Cost/lane mile/year = $5646.08
Design life: 20 years – Cost/lane mile/year = $7057.50

HMA Overlay – expected life 11-13 years
165# HMA Surface = 0.0825T/sys - @$53.25/T = $4.39/sys
275# HMA Intermediate = 0.1375T/sys - @ $53.00/T = 7.29/sys

Cost/lane mile/year (at 11 years) = $7475.20
Cost/lane mile/year (at 13 years) = $6325.17
Questions?

Contacts for further information

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